

Claims

- Sub 1*
1. A two-speed drive mechanism for a wheelchair, comprising:
- a wheelchair wheel;
 - a hand rim to drive the wheelchair wheel;
 - a gear assembly which includes a first gear arrangement for driving the wheelchair in a first, 1:1 gear ratio and a second hypocycloidal arrangement for driving the wheelchair in a second, lower gear ratio;
 - a support assembly for mechanically linking the hand rim and the gear assembly; and
 - means for shifting between the two gear arrangements.
2. A mechanism of claim 1, wherein the first gear ratio is 1:1 and the second gear ratio is lower than 2:1.
3. A mechanism of claim 1, wherein the shifting means moves in a planar direction, perpendicular to an axle for the wheel, to accomplish shifting between the two gear arrangements.
4. A mechanism of claim 1, wherein the gear assembly includes a gear plate having a ring gear defined therein and a gear segment mounted to a shift member in the support assembly which moves between two positions, the gear segment engaging the ring gear and driving the ring gear and said gear plate in the first, 1:1 gear ratio when the shift member is in a first position, the gear assembly further including a spur gear mounted on a restraining plate, the restraining plate in operation orbiting with the spur gear in a hypocycloidal pattern, the spur gear engaging the ring gear and driving the ring gear and the gear plate in the second, lower gear ratio when the shift member is in a second position.
5. A mechanism of claim 3, including portions at opposite ends of the shift member which are differentiated from each other in a tactile manner, so that the user can readily determine

which portion to use to shift the gear assembly from one gear ratio to the other gear ratio.

6. A mechanism of claim 4, wherein one portion has a smooth edge and the other portion a wavy edge.

7. A mechanism of claim 3, wherein the hypocycloidal gear arrangement includes a fixed plate having a plurality of circular openings spaced around the face thereof, wherein the restraining plate includes a plurality of roller elements which extend from a rear surface thereof and which engages the circular openings in the fixed plate, so that as the hand rim is rotated by the user, the shift member rotates, the spur gear moves in a non-rotating hypocycloidal pattern, driving the ring gear and in turn the wheelchair wheel.

8. A mechanism of claim 3, including a second gear plate having the same diameter as the first gear plate and positioned inwardly toward the wheel, the first and second gear plates being joined by a plurality of one-direction roller elements having central shafts therein, around the periphery thereof, the roller elements permitting rolling movement in one rotational direction but not the other, and wherein the support assembly includes a housing in which the shift member is mounted and into which the gear mechanism is mounted, the housing being arranged so that an exterior surface of the roller elements frictionally engage an interior surface of the housing, in such a manner that when the spur gear is engaged and moving in a hypocycloidal pattern, the wheelchair wheel is free to roll in the forward rotational direction but is prevented from moving in the reverse direction due to unbalanced hypocycloidal gear and restraint loads, unless a user moves the hand rim in the reverse direction to reduce the gear and restraint loads and allow sliding of the roller elements relative to said interior surface of the housing.

9. A mechanism of claim 7, wherein an inwardly directed portion of the user's braking force on the hand rim produces a

frictional effect between the interior surface of the housing and a number of stationary friction elements within the housing, such frictional effect assisting in the braking action for the wheelchair.

10. A mechanism of claim 8, including brake elements positioned between the hand rim and a rim of the wheel, the brake elements meeting together and compressing in response to said inwardly directed force portion.

11. A mechanism of claim 1, wherein the mechanism is mounted on an axle having a quick-release capability relative to the wheelchair.

12. A mechanism of claim 1, wherein the wheelchair must be stopped before the shifting means can be operated.

13. A multi-speed drive mechanism for a manual wheelchair, wherein the drive mechanism can be shifted by a user while sitting in the wheelchair, comprising:

a wheelchair wheel;

a hand rim to drive the wheelchair wheel;

a gear assembly which includes a first gear arrangement for driving a wheelchair in a first gear ratio and a second gear arrangement for driving the wheelchair in a second gear ratio;

a linking structure which connects the hand rim to the gear assembly; and

means mounted on the linking structure for shifting between the two gear arrangements, wherein the shifting means moves in a planar direction, perpendicular to an axle for the wheel.

14. A mechanism of claim 12, wherein the first gear ratio is 1:1 and the second gear ratio is lower than 1:1.

15. A mechanism of claim 12, wherein the shifting means includes a shift member which moves between first and second positions, wherein in the first position the first gear arrangement

is engaged which results in the wheelchair being in the first gear ratio, and wherein in the second position, the second gear arrangement is engaged which results in the wheelchair being in the second gear ratio.

16. A mechanism of claim 12, including first and second locking elements on opposing end portions of a shift member portion of the shifting means, wherein when the shift member is in one of the first and second positions, a first locking element can be released to permit the shift member to be moved to the second position.

17. A mechanism of claim 12, wherein the gear assembly is arranged such that the wheelchair must be stopped and the gear assembly unloaded before the shifting means can be operated, wherein the hand rim remains connected to the drive wheel during shifting between the two gear arrangements.

18. A multi-speed drive mechanism for a wheelchair, comprising:

a wheelchair wheel;

a hand rim to drive the wheelchair wheel;

a gear assembly which includes a first gear arrangement for driving the wheelchair in a first gear ratio and a second arrangement for driving the wheelchair in a second, lower gear ratio;

a support assembly for mechanically linking the hand rim and the gear assembly; and

means for shifting between the two gear arrangements, wherein the shifting means includes a shift member used to shift between said first and second gear ratios, the shift member having at least two portions which are differentiated from each other in a tactile manner so that a user can readily determine which portion to use to shift the gear assembly from one gear ratio to another selected gear ratio.

19. A mechanism of claim 17, wherein the two portions are differentiated from each other by configuration.

20. A mechanism of claim 18, wherein one portion has a smooth contact section which is associated with a gear ratio suitable for a flat terrain and wherein the other portion has a wavy contact section which is associated with a gear ration suitable for a hilly terrain.

21. A mechanism of claim 17, wherein the two portions can be distinguished by a user wearing gloves.

22. A wheel assembly for a manual wheelchair, comprising:

a wheelchair wheel;
a hand rim to drive the wheelchair wheel;
a housing assembly connected to the hand rim;
a cage assembly fixedly secured to the wheel, the cage assembly including two spaced cage plates and a plurality of single-direction rollers extending therebetween around the periphery thereof, permitting rolling movement in one rotational direction but not the other direction, wherein the inner cage assembly is mounted within the housing such that the rollers contact the inner surface of the housing and wherein a frictional locking force is created between the rollers and the housing that increases as the torque on the wheel increases when the wheelchair is traversing an incline, but such that the housing can be rotated in the reverse direction by a user's use of the hand rim; which results in a sliding action between the rollers and the housing; and

a gear assembly linking the housing assembly to the cage assembly, such that as the hand rim is rotated, the wheel rotates therewith.

23. An assembly of claim 21, wherein the rollers include at least three spaced rollers, and wherein the rollers have an outer surface with at least one selected physical characteristic which increases the coefficient of friction between the rollers and the

housing sufficiently to generally prevent rolling movement of the rollers in said other rotational direction.

24. An assembly of claim 22, wherein the selected physical characteristic is a selected material which increases the coefficient of friction.

25. An assembly of claim 22, wherein the gear assembly includes a hypocycloidal gear arrangement which includes a ring gear in one of the cage members and a spur gear mounted so as to orbit within and engaging the ring gear, without rotation of the spur gear, the spur gear following a hypocycloidal path.

26. An assembly of claim 17, wherein inwardly directed force on the hand rim that produces a direct stopping action on the hand rim causes frictional contact between (a) selected rubbing elements on the cage assembly and (b) said housing or between selected rubbing elements on (c) the hand rim and (d) the wheel, which increase the stopping action on a decline surface.

27. A quick-release wheel assembly for a wheelchair, comprising:

a wheel assembly, which includes a wheelchair wheel, a hand rim to drive the wheel and a support mechanism linking the hand rim and the wheel;

a hub assembly on which the wheel assembly is mounted, the hub assembly including an axle which in turn includes a quick-release element which is spring actuated such that the axle fits into and is removed from a receiving member on the wheelchair when the spring-actuated element is in an actuated position and such that the axle is locked into the receiving member when the spring-actuated element is in a non-actuated position; and

a positioning member mounted to an inboard end of the hub assembly which mates with a non-rotating portion of the receiving member on the wheelchair so that the hub assembly cannot rotate relative to the receiving member and hence the wheelchair.

28. An assembly of claim 26, wherein the quick-release element includes a ball detent near an inboard end of the axle and a spring-loaded cylinder which extends through the axle and interacts with the ball detent such that when the cylinder is moved into a first position against the action of the spring, the ball detent element can be moved inwardly for release of the wheel assembly from the wheelchair and such that when the cylinder is in a second position, the ball detent prevents removal of the axle ~~from~~^{from} the wheelchair.

29. An assembly of claim 21, wherein the positioning member and the receiving member are different in configuration for the left and right-hand wheels on a wheelchair, such that the left-hand wheel can be mounted only on the left side of the wheelchair and the right wheel can be mounted only on the right side of the wheelchair.

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